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CORONA/GAMBIT

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USIB-D-41.18/6
(COMOR-D-56/68)
5 January 1965
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UNITED STATES INTELLIGENCE BOARD

MEMORANDUM FOR THE UNITED STATES INTELLIGENCE BOARD

SUBJECT : Statistical Evaluation of the First Fourteen GAMBIT
Missions with Specific Attention to GAMBIT Mission 4011

REFERENCE : USIB-D-41.18/4 (COMOR-D-24/182)
18 December 1964, Limited Distribution

1. At the direction of the Chairman, United States Intelligence Board (USIB), the attached papers on the subject, prepared as indicated in the memorandum by the Chairman, Committee on Overhead Reconnaissance (COMOR), is circulated for the information of USIB.

2. Since these papers were prepared as an evaluation of GAMBIT missions comparable to the evaluation of Mission 1014-J in the reference, the attached is scheduled for discussion by the Board at its 6 January meeting immediately following discussion of the reference,

JAMES S. LAY, JR.
Executive Secretary

STAT

Attachment

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UNITED STATES INTELLIGENCE BOARD

MEMORANDUM FOR THE UNITED STATES INTELLIGENCE BOARD

SUBJECT: Statistical Evaluation of the First Fourteen
GAMBIT Missions with Specific Attention
to GAMBIT Mission 4011

REFERENCE: Evaluation of Mission 1014 [redacted]
[redacted] USIB-D-41.18/4 (COMOR-D-24/182)

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1. In connection with his review of the reference paper, the Chairman, USIB requested a comparable evaluation of GAMBIT missions. His question was in particular provoked by the table in Tab B of the reference.

2. The Chairman, COMOR requested the Chairman of the COMOR Photo Working Group (PWG) to provide a response to this request based on information available to the PWG. Because the PWG is primarily concerned with requirements the studies were an effort to evaluate the degree to which the program as a whole has responded to requirement guidance from COMOR. Factors affecting performance which recurred or seemed to be dominant were taken into account, but no attempt was made to conduct a thorough technical and comprehensive study of the reasons for failures or partial failures.

3. Attached are two papers which are the result of the studies:

a. "Statistical Evaluation of the First Fourteen
GAMBIT Missions" (Tab A), and

b. "Statistical Evaluation of GAMBIT Mission
4011" (Tab B).

STAT

[redacted]
James Q. Reber
Chairman

Attachments:
Tabs A & B.

Committee on Overhead Reconnaissance

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Tab A

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Statistical Evaluation of the First Fourteen GAMBIT Missions

1. The purpose of this study is to evaluate the degree to which individual GAMBIT missions and the program as a whole have responded to requirements submitted by the COMOR. Whenever possible it indicates some of the factors which have affected performance. The analysis is based primarily on the photographic results as reported by NPIC in OAKs and MCIs and to a lesser degree on post-mission information furnished the COMOR by the (S) NRO.

2. General information for the first fourteen GAMBIT missions is as follows:

<u>GAMBIT Missions</u>				
<u>Missions</u>	<u>Launch Date</u>	<u>Days Opr.</u>	<u>Recovered</u>	<u>Remarks</u>
4001	12 Jul 63	1	Yes	No roll, unstable 3 targets reported
4002	6 Sep 63	2	Yes	No roll 10 targets reported
4003	25 Oct 63	2	Yes	No roll 2 targets reported
4004	18 Dec 63	1	Yes	OCV failure, vehicle unstable
4005	25 Feb 64	1	Yes	OCV failure, 1st roll attempts, smeared photos
4006	11 Mar 64	3	Yes	170 targets reported
4007	23 Apr 64	4	Yes	206 targets reported
4008	19 May 64	2	Yes	OCV failure, possibly unstable, 52 targets reported
4009	6 Jul 64	2	Yes	OCV failure, unstable

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<u>Missions</u>	<u>Launch Date</u>	<u>Days Opr.</u>	<u>Recovered</u>	<u>Remarks</u>
4010	14 Aug 64	1	Yes (4th day)	Command problems, 66 targets reported
4011	24 Sept 64	4	Yes	244 targets reported
4012	8 Oct 64	0	No	Agena failure
4013	23 Oct 64	4	No	Recovery sequence failed
4014	4 Dec 64	1	Yes	Power failure to stabilization systems, 35 targets reported

3. a. To summarize the above it can be noted that no GAMBIT mission to date can be considered as having achieved its full potential. *Due to system malfunctions* no useable photographs were obtained from Missions 4004, 4005, 4009, 4012, and 4013.

b. Missions 4001 through 4003 were not programmed to roll, consequently they were able to photograph only the limited number of assigned targets within the 10 to 12 mile photo swath lying directly under their tracks. This factor, in conjunction with the fact that they were missions of short duration, accounted for the limited number of targets acquired.

c. Missions 4008, 4010, and 4014, while enhanced by the camera roll capabilities, suffered from technical difficulties and;

d. Even missions 4006, 4007, and 4011 did not fly five days as scheduled.

4. The tables which follow present detailed data related to the degree to which the GAMBIT program has responded to intelligence requirements. They include information on the number of targets obtained in stereo and mono; the number of targets photographed in clear weather, in scattered clouds, in total cloud cover; and the number of priority targets covered. An attempt is also made to determine the reasons underlying failure to obtain photography on priority targets.

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5. Effect of Priorities on Target Coverage

(Stereo and Mono, 1st 3 Priorities, All Weather)

<u>Mission</u>	<u>Assigned Priority</u>	<u>Priority Targets Photographed</u>	<u>Per Cent</u>
4002	Not available*	5	--
4003	Not available*	3	--
4006	93	54	58
4007	186	99	54
4008	154	20	13
4010	181	16	9
4011	195	93	48
4014	257	30	12

*Because they were assigned before the use of the computer and the record was not kept.

As may be noted in the above table, different numbers of priority targets were assigned for the individual missions. Priorities were established based on intelligence requirements(modified in some cases by knowledge of the planned mission éphemeris which permitted insight into mission capability) and the practice of using target priorities to assist in obtaining maximum utilization of camera operations available. It demonstrates the responsiveness of the camera programming to the guidance submitted via target priorities and also demonstrates that pointing accuracy can be expected. In general the success of a given mission is directly related to proper functioning as designed and to the length of time in orbit. In the cases of Missions 4008, 4010 and 4014 limited target coverage was caused by the fact that these missions were hampered by technical difficulties and were recovered after only one or two days in orbit.

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6. Effect of Specific Priority Values on Target Coverage
(Stereo and Mono, All Weather)

Mission	Number of Priority 1			Number of Priority 2			Number of Priority 3		
	Targets	Photographed	Per Cent	Targets	Photographed	Per Cent	Targets	Photographed	Per Cent
4006	32	21	66	40	22	55	21	11	52
4007	28	22	79	63	30	48	95	47	49
4008	16	3	19	48	7	15	90	10	11
4010	30	6	20	56	2	4	95	8	8
4011	55	35	64	42	19	45	98	39	40
4014	56	8	15	69	11	16	132	11	9

As the above table shows, there is a higher degree of success in obtaining coverage of first priority targets than those assigned Priorities 2 and 3. This is part of the GAMBIT system design and obviously is working. As many as possible of the Priority 1 targets were used in the orbit select program (TOSP). Inclusion of these targets in this program almost guarantees that the mission will be programmed to fly in such proximity to them that photography can be obtained. Again it should be noted that success in obtaining photography of first priority targets is directly related to mission duration. In fact, had these missions successfully flown for the time planned, it is estimated that nearly all of the first priority targets would have been photographed. Insofar as Mission 4011 is concerned, it is believed that the high degree of success in photographing priority targets can be credited to the fact that pre-mission ephemeris information (including roll angles, sun angle, and distance between targets) was provided to COMOR for use in the assignment of target priorities.

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7. Responsiveness to Requirements for Stereo

(All Weather, 1st 3 Priorities)

<u>Mission</u>	<u>Priority Targets Photographed</u>	<u>Stereo</u>	<u>Mono</u>
4002	5	5	0
4003	3	3	0
4006	54	45	9
4007	99	76	23
4008	20	17	3
4010	16	12	4
4011	93	83	10
4014	30	Not available	Not available

The above table demonstrates that the GAMBIT system has the capability to photograph a high percentage of targets in stereo when that mode is stipulated by the COMOR. It does not answer the question of the number of lower priority targets that could have been photographed in mono had mono coverage of high priority targets been authorized.

8.

Weather Distribution

(Stereo and Mono, 1st 3 Priorities)

<u>Mission</u>	<u>Total</u>	<u>Clear</u>	<u>Scattered Clouds</u>	<u>Obscured</u>
4002	5	5	0	0
4003	3	1	0	2
4006	54	26	9	19
4007	99	55	10	34

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<u>Mission</u>	<u>Total</u>	<u>Clear</u>	<u>Scattered Clouds</u>	<u>Obscured</u>
4008	20	7	1	12
4010	16	12	2	2
4011	93	38	11	44
4014	30	3	5	22

Since the GAMBIT system is limited by factors other than film, no efforts are made to conserve film over targets anticipated to be covered by bad weather. Until ways are found to increase mission life or to hold launches for optimum weather over target areas, it appears that little advantage will accrue in playing weather as is accomplished in the management of the CORONA system.

9. Priority Targets Not Photographed

<u>Mission</u>	<u>Number</u>	<u>Cause of No Picture</u>							
		<u>a</u>	<u>Per Cent</u>	<u>b</u>	<u>Per Cent</u>	<u>c</u>	<u>Per Cent</u>	<u>d</u>	<u>Per Cent</u>
4006	39	18	46	2	5	3	8	16	41
4007	87	42	48	12	14	4	5	29	33
4008	134	118	86	5	4	5	4	6	6
4010	165	151	92	7	4	3	2	4	2
4011	102	38	37	36	35	6	6	22	22
4014*									

a - beyond swath capability

b - competition with the same or higher priority

c - competition with lower priority (could be rx)

d - unknown not known cause

* Data not yet available

This table demonstrates the impact of short mission life and target conflict on obtaining coverage of priority targets. On Missions 4008 and 4010, which only flew one or two days, most targets missed were beyond the swath width of the limited number of passes flown. On the other hand,

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the longer life missions (4006, 4007 and 4011) were affected to considerable extent by target conflicts caused by geographic location. This competition will continue to be troublesome until more targets have received first-time GAMBIT coverage, at which time their priority will be reduced so as to avoid conflict.

10. Conclusions:

a. The GAMBIT missions which have been recovered have demonstrated that the system has the capability to respond and does respond to the priority guidance provided by COMOR. This priority guidance is most effective when mission data including nominal ephemeris information is available to aid in target priority assignment.

b. Failure of missions to fly their intended duration has been the primary reason for the limited number of targets photographed.

c. Bad weather over pinpoint targets is an inhibiting factor which cannot be overcome by the GAMBIT system as it is now constituted.

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Tab B

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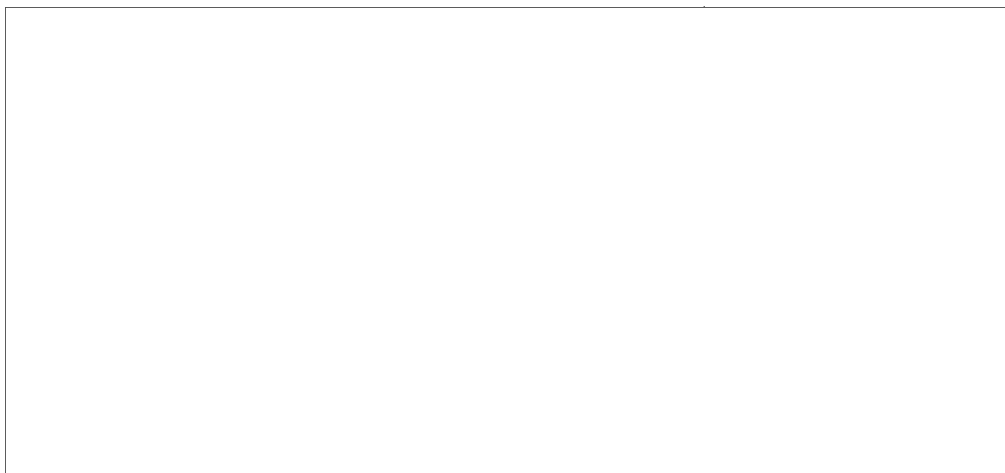
Statistical Evaluation of GAMBIT Mission 4011

1. The purpose of this study is to evaluate the degree to which Mission 4011 responded to COMOR requirements as a whole while giving particular attention to two "principal targets" which were difficult to photograph on the same mission. Whenever possible, it indicates some of the factors which have affected performance. The analysis is based primarily on the photographic results as reported by NPIC in the OAK and the MCI and to a lesser degree on post-mission information furnished the COMOR by the (S) NRO.

2. Mission 4011 was scheduled to fly five days against a total of 2796 targets assigned priorities as follows:

<u>Priority</u>	<u>Number of Targets</u>
1a	2
1b	27
1c	26
2	42
3	98
4	2456
5	145

3. As indicated in paragraph 1, priority assignments were influenced by the following major considerations:



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b. The priority values actually assigned were often selected so as to maximize camera operations and thus acquire photography of the greatest number of targets possible. This use of priorities sometimes resulted in a relatively low priority target being assigned a high priority to assure the camera's being turned on over locations where a number of targets could be photographed on one burst. On the other hand, some targets, which because of intelligence importance merited a high priority, were not assigned that priority since their geographic location permitted a picture to be taken even with low priority.

c. In addition, to assure maximum intelligence take in case the actual orbit deviated from that planned, an attempt was made to "salvage" by assigning priorities which would result in the programming of very important but lower priority targets. As a result, the number of high priority targets was artificially increased (even to the point of creating high priority target conflicts if the mission performed as planned).

d. The lowest priority was assigned those targets previously photographed by GAMBIT missions but of sufficient intelligence interest as to warrant recoverage if not in conflict with other targets.

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4. The following table contains details of targets photographed showing coverage by priority, mode of coverage (stereo and mono) and existing weather.

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	a	Priority 1 b	c	Total	Priority 2	Priority 3	Total Priority 1-3	Priority 4	Priority 5	TOTAL
Total Targets Submitted	2	27	26	55	42	98	195	2456	145	2796
Targets Photographed in Stereo	2	18	11	31	16	36	83	253	14	350
Clear	2	7	4	13	9	11	33	79	8	120
Scattered Clouds		2	2	4		2	6	28	2	36
Obscured by Clouds		9	5	14	7	23	44	146	4	194
Targets Photographed in Mono		2	2	4	3	3	10	145	18	173
Clear		2	1	3		2	5	48	2	55
Scattered Clouds			1	1	3	1	5	24	4	33
Obscured by Clouds								73	12	85
TOTAL Targets Photographed	2	20	13	35 ^a	19	39	93 ^b	398	32	523 ^c

a - 65% of Priority 1 targets

b - 48% of Priorities 1 - 3

c - 19% of all targets

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5. a. As also shown in the above table, a greater percentage of targets in high priority categories were photographed than were those in lower priority categories. This occurred in part because there were a greater number of lesser priority targets in competition for coverage by the limited number of camera operations available. It also occurred for the reasons explained in paragraphs 3b and c above.

b. At the time of launch of Mission 4011, the USIB requirement stipulated that stereo photography was required on all high priority targets. As indicated in the table, this mission photographed 83 targets in stereo, 44 of which were obscured by cloud cover. Ten priority targets were reported by NPIC as covered by mono rather than stereo photography. However, the mission data provided COMOR by the (S) NRO indicated that stereo photography was attempted on these same targets. In our investigation we considered the possibility that cloud cover over one portion of what should have been a stereo pair precluded acquisition of stereo coverage. This apparently occurred on five of the targets (those covered with scattered clouds) leaving five which we must conclude were simply missed in stereo.

6. The following table provides an analysis of the reason for failure to obtain photography of priority targets. It should be noted that a substantial number of the targets not photographed (about one third) were in conflict with targets of higher priority.

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Reason for Failure to Obtain Photography	Priority 1				Priority 2	Priority 3	TOTAL
	a	b	c	Total			
a. Beyond Range*		6	3	9	5	24	38
b. Conflict with Higher Priority Target			2	2	13	19	34
c. Conflict with Equal Priority Target					2	6	8
d. Undetermined		1	8	9	3	10	22
TOTAL		7	13	20	23	59	102

*Caused in part by failure to fly full five days

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a

b

c

- d Additional targets would have come within camera range had this mission flown 5 days as planned and if the orbit adjust operations explained in Tab B had not been undertaken.

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8. Conclusions:

a. Based on the degree of success in acquiring photography of COMOR targets but excluding considerations related to photo quality (excessive IMC, poor resolution, low contrast, small scale, etc.), Mission 4011 must be considered to be the most effective of the GAMBIT series.

b. A reason for the high degree of success in acquiring desired photos can be attributed to the fact that pre-launch mission ephemeris was provided to the COMOR, thus enabling it to assign priorities in such a manner as to maximize the photographic take.

c. Mission 4011 demonstrated that the GAMBIT target-spotting and aiming system is extremely accurate. Furthermore, it confirmed that efforts to assign exact geographic coordinates to targets paid off since a very high percentage of targets were so framed that stereo coverage was obtained.

d. While the orbit adjust capability permitted good coverage of two very high priority targets, it must be recognized that its use caused orbit traces to group, thus severely limiting the geographic area brought within camera range.